Claims

[c1] 1.A bus-based network switch comprising:

a plurality of switch nodes, each switch node for receiving a data payload from an input port or for transmitting a data payload to an external network device through an output port;

a first bus for sending switch packets with the data payload in a first direction among the plurality of switch nodes, the first bus being divided into links, each link for transferring a switch packet between two of the switch nodes;

a second bus for sending switch packets with the data payload in a second direction among the plurality of switch nodes, the second bus being divided into links, each link for transferring the switch packet between two of the switch nodes;

wherein the plurality of switch nodes are arranged in a continuous loop wherein a destination switch node in the plurality of switch nodes can be reached from any other switch node in the plurality of switch nodes both by following the continuous loop in the first direction and by following the continuous loop in the second direction; and

a packet limiter that limits a number of switch nodes that the switch packet travels through from a source switch node that receives the data payload to the destination switch node that transmits the data payload from the switch packet to the output port;

wherein the packet limiter limits the number of switch nodes to less than a total number of the switch nodes in the plurality of switch nodes,

whereby the switch packet travels through a limited number of the switch nodes.

[c2] 2.The bus-based network switch of claim 1 wherein the packet limiter limits the number of switch nodes to half or less of the total number of switch nodes in the plurality of switch nodes,

whereby the switch packet travels no more than half-way around the continuous loop of switch nodes.

[c3] 3.The bus-based network switch of claim 2 wherein the switch packet comprises a header and the data payload, the header including a destination identifier that uniquely identifies the destination switch node from other nodes in the plurality of switch nodes;
wherein the header is attached to the data payload before the source switch node sends the switch packet over the first or second bus;
wherein the header is removed from the data payload after the destination switch node receives the switch packet but before the data payload is transmitted out the output port without the header.

[c4] 4.The bus-based network switch of claim 3 wherein the packet limiter is a distance value in the header that specifies a limited number of switch nodes that the switch packet can travel through before the switch packet is removed by a switch node.

[c5] 5.The bus-based network switch of claim 4 wherein each switch node receiving a switch packet decrements the distance value;
wherein a switch node removes a switch packet with a distance value that is below a removal threshold value by not sending the switch packet to a next switch node,
whereby the distance value is decremented for each switch node the switch packet passes through until the removal threshold value is reached and the switch packet is removed.

[c6] 6.The bus-based network switch of claim 3 wherein the packet limiter is a bit-mask in the header, the bit mask identifying one or more of the switch nodes that are to receive the data payload in the switch packet.

[c7] 7.The bus-based network switch of claim 6 wherein each switch node copies the data payload from the switch packet when a bit in the bit mask corresponding to the switch node is set and clears the bit before sending the switch packet on to a next switch node.

[c8] 8.The bus-based network switch of claim 7 wherein the switch packet is

removed by a switch node when all bits in the bit mask are cleared.

[c9] 9.The bus-based network switch of claim 3 wherein the packet limiter is a source monitor in each switch node, the source monitor comparing a removal identifier in the header to a predetermined identifier to indicate when the switch node is to remove the switch packet and not send it to a next switch node.

[c10] 10.The bus-based network switch of claim 9 wherein the removal identifier is a source node identifier that identifies a source switch node that received the data payload in the switch packet from an input port attached to the source switch node.

[c11] 11.The bus-based network switch of claim 10 wherein a broadcast switch packet is duplicated to form a first packet and second packet with a same data payload, with the first packet sent from a source switch node over the first bus in the first direction while the second packet is sent from the source switch node over the second bus in the second direction,
whereby broadcast packets are sent in both directions over both the first and second bus.

[c12] 12.The bus-based network switch of claim 11 wherein a unicast switch packet intended for only one output port is transmitted over either the first bus or the second bus but not over both buses,
whereby the unicast switch packet is sent in only one direction.

[c13] 13.A method for switching data using a bus-based network switch with switch nodes comprising:
receiving at an input port coupled to a source switch node a data payload for switching to an output port coupled to a destination switch node;
generating a header for a switch packet that contains the data payload received by the input port, the header identifying the destination switch node;
injecting the switch packet at the source switch node and sending the switch

packet to a next switch node along a first bus in a first direction toward the destination switch node or sending the switch packet to a next switch node along a second bus in a second direction toward the destination switch node, the destination switch node being reachable by both the first and the second bus;

at each next switch node along the first bus when the switch packet is sent over the first bus:

receiving the switch packet from a first-bus input to the next switch node;

examining the header of the switch packet to determine if the data payload is intended for an output port coupled to the next switch node;

copying the data payload but not the header to the output port coupled to the next switch node when the header indicates that the data payload is for the output port;

reading a field in the header to determine if the switch packet should be removed;

sending the switch packet out a first-bus output to another next switch node over the first bus when the switch packet is not to be removed, but not sending the switch packet out the first-bus output when the next switch node determines that the switch packet is to be removed;

at each next switch node along the second bus when the switch packet is sent over the second bus:

receiving the switch packet from a second-bus input to the next switch node;

examining the header of the switch packet to determine if the data payload is intended for an output port coupled to the next switch node;

copying the data payload but not the header to the output port coupled to the next switch node when the header indicates that the data payload is for the output port;

reading a field in the header to determine if the switch packet should be removed; and

sending the switch packet out a second-bus output to another next switch node over the second bus when the switch packet is not to be removed, but

not sending the switch packet out the second-bus output when the next switch node determines that the switch packet is to be removed, whereby switch packets are routed over the first or second bus.

[c14] 14.The method of claim 13 when the switch packet is intended for many output ports and further comprising:
duplicating at least part of the switch packet including the data payload to generate a second switch packet;
injecting the switch packet at the source switch node and sending the switch packet to a next switch node along the first bus in the first direction toward the destination switch node;
also injecting the second switch packet at the source switch node and sending the second switch packet to a next switch node along a second bus in a second direction toward the destination switch node,
whereby switch packets are sent over the first bus in the first direction and over the second bus in the second direction to reach output ports.

[c15] 15.The method of claim 13 wherein the first direction is opposite to the second direction.

[c16] 16.The method of claim 15 wherein reading a field in the header to determine if the switch packet should be removed comprises:
reading and decrementing a distance value in the header that indicates a number of next switch nodes that is half or less of a total number of switch nodes; and
comparing the distance value to a threshold.

[c17] 17.The method of claim 15 wherein reading a field in the header to determine if the switch packet should be removed comprises:
reading a bit mask in the header that indicates which switch nodes are destination switch nodes;
resetting a bit in the bit mask for the next switch node; and
wherein the switch packet is removed by the next switch node when no bits in the bit mask indicate remaining destination switch nodes.

[c18] 18.The method of claim 15 wherein reading a field in the header to determine if the switch packet should be removed comprises:
reading a removal field in the header that identifies a next switch nodes that is to remove the switch packet.

[c19] 19.A network switch comprising:
a plurality of switch node means, coupled to input-port means for receiving data sent to the network switch and output-port means for transmitting data from the network switch, each switch node means having a first-bus input, a first-bus output, a second-bus input, and a second-bus output;
first bus means for sending packets partially along a loop of the plurality of switch node means in a forward direction, having a plurality of first link means for sending the packets between two switch node means, each first link means being coupled to the first-bus output of a switch node means and to a first-bus input of an adjacent switch node means;
second bus means for sending packets partially along the loop of the plurality of switch node means in a reverse direction, having a plurality of second link means for sending the packets between two switch node means, each second link means being coupled to the second-bus output of a switch node means and to a second-bus input of an adjacent switch node means; and
removal means, in each switch node means, for determining if the switch node means is halfway around the loop from a source switch node means that received the data from the input-port means, the removal means preventing the packet from being sent by the first or second link means to another switch node means when the packet is removed,
whereby packets are removed halfway around the loop.

[c20] 20.The network switch of claim 19 wherein the removal means comprises means for reading a field in a header of the packet, and means for comparing the field to a predetermined value to determine when to remove the packet.